



ATEC Project No. 2014-DT-DPG-JUPIT-F9780
WDTC Document No. WDTC-RR-15-052



DEPARTMENT OF THE ARMY
US ARMY DUGWAY PROVING GROUND
DUGWAY, UTAH 84022-5000

TEST RECORD
FOR THE JOINT US FORCES KOREA (USFK)
PORTAL AND INTEGRATED THREAT RECOGNITION (JUPITR)
ADVANCED TECHNOLOGY DEMONSTRATION (ATD)
EARLY WARNING (EW) LEG TECHNICAL DEMONSTRATION (TD)

Brief Description of Test: Provide simulant clouds and interferents to challenge chemical and biological detector candidates for the Joint US Forces Korea (USFK) Portal and Integrated Threat Recognition (JUPITR) system.

Type Test and Item: Advanced Technology Demonstration (ATD); proprietary detector technologies from multiple vendors.

Location of Test: West Desert Test Center (WDTC), US Army Dugway Proving Ground (DPG), Utah.

Dates of Test: 22 through 28 February 2015.

Authority: On 10 March 2014, US Army Test and Evaluation Command (ATEC), Aberdeen Proving Ground (APG), Maryland, issued a test support order through the ATEC Decision Support System (ADSS) authorizing WDTC, DPG, to conduct the JUPITR ATD Early Warning Leg (EW) Technical Demonstration (TD), ATEC Project Number 2014-DT-DPG-JUPIT-F9780.

1. TEST ITEM

a. The JUPITR system is a near- and mid-range Fourier-transform infrared (FTIR) spectroscopy system comprising several subsystems used to detect and analyze bioaerosol clouds. Multiple chemical and biological detection systems were tested during the JUPITR ATD EW TD as possible candidates to be incorporated into the JUPITR system. Candidate systems were brought to the test site and operated by participant vendors. DPG provided simulant releases to challenge



DEPARTMENT OF THE ARMY
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TEDT-DPW-LS

August 2015

MEMORANDUM FOR US Army Test and Evaluation Command (ATEC) Army Evaluation Center (AEC), Test Operations Division (CSTE-TM/M. Joiner), 2202 Aberdeen Boulevard, Aberdeen Proving Ground, MD 21005-5001

SUBJECT: Test Record for the Joint US Forces Korea (USFK) Portal and Integrated Threat Recognition (JUPITR) Advanced Technology Demonstration (ATD) Early Warning (EW) Leg Technical Demonstration (TD), US Army Test and Evaluation Command (ATEC) Project Number 2014-DT-DPG-JUPIT-F9780, West Desert Test Center (WDTC) Document Number WDTC-RR-15-052

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3. TEAM DUGWAY – Empowering the Nation’s Defenders!

E-Signed by HARRIS.RYAN.WADE.1152106692
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Encl

RYAN W. HARRIS
Director, West Desert Test Center

the candidate systems. The purpose of the 4-year JUPITR ATD is to provide unique biological detection capabilities that will address the demand for stronger biosurveillance capabilities on the Korean Peninsula.

b. The JUPITR system consists of four legs: the biosurveillance portal, the biological identification capability sets, assessment of environmental detectors, and the chemical/biological (CB) early warning leg. Only the CB early warning leg was tested and is reported in this test record. Other legs will be tested and reported separately.

c. The CB early warning leg will combine the proven force protection capability of integrated base defense systems with mature CB standoff and point systems to provide an earlier warning of a CB attack.

2. SUPPORTING MATERIEL, FACILITIES, AND INSTRUMENTATION

a. Facilities. Field testing was conducted at Target S, DPG.

b. Referee Instrumentation

(1) The Aerodynamic Particle Sizer[®] (APSTM, TSI, Shoreview, Minnesota) was used as a point detector to measure biological and other particles per liter (ppL) of air and particle size distribution (PSD).

(2) A Portable Weather Instrumentation Data System (PWIDS) was used to record temperature, relative humidity (RH), wind speed, and wind direction during testing.

(3) The West Desert Light Detection and Ranging (LIDAR) (WDL) system was used as a referee LIDAR system.

c. Dissemination Instrumentation

(1) Skil[®] blowers (Robert Bosch Tool Corporation, Mt. Prospect, Illinois) were used to disseminate dry biological simulants or dust.

(2) Air cannons were used to disseminate dry simulants.

(3) A burn pan was used to produce interferents by burning rubber, brush, and alfalfa.

(4) Composition C-4 (C-4) explosive detonations were used for air vapor dissemination of chemical simulants.

(5) An eductor dry dissemination system (EDDS) was used to disseminate dry compounds.

3. TEST OBJECTIVES

a. Optimize detection and discrimination algorithms.

b. Conduct a dry run of the technical demonstration that will expose the integrated system to a suite of threat representative vignettes and interferents.

c. Demonstrate the utility of the fusion of CB sensors with force protection (FP) sensors in providing EW.

NOTE: These objectives have been altered from the operations plan (OPLAN, Reference 1). Objectives specifying the use of an aerostat during testing were removed by customer request.

4. DETAILS OF TEST

a. General Procedures

(1) All participants (including DPG personnel and the test participants), were assigned a unique call sign for test site entry/exit. The call sign master list was held by the JUPITR ATD EW TD test officer (TO). At the end of each testing day, any anticipated changes to the JUPITR ATD EW TD schedule were announced at the command post (CP) before dismissal. For more immediate schedule changes, such as imminent bad weather, everyone on the grid was in radio contact.

(2) All participants attended a daily safety briefing and initialed the attendance roster.

(3) All grid access was coordinated through the CP and was approved by the TO. All foreign nationals were escorted by US Government personnel at all times.

(4) Any participants arriving late were required to sign in at the CP and were informed of the information contained in the day's safety briefing.

(5) All dissemination and referee system data were collected at the end of each night of testing and uploaded to a test computer by DPG personnel. The test computer was not part of any participant-provided technology. All referee data were archived and stored on the test network.

(6) Chemical sensors were locally stimulated using methyl salicylate (MeS) in a specialty gas cylinder with remote actuation via a solenoid.

b. Challenge Material Preparation

(1) The biological and chemical simulants for this test were as follows:

(a) Biological simulants included *Bacillus atrophaeus* (BG) and *Bacillus thuringiensis kurstaki* (Btk).

(b) Chemical simulants included MeS and sulfur hexafluoride (SF₆).

(2) The chemical challenge materials were obtained from commercial vendors. The biological challenge materials were produced at DPG. If available, the source, batch record, and lot numbers for each challenge material were recorded and provided to the test participants. DPG conducted all quality control procedures necessary to characterize the biological challenge materials. Quality control data were collected.

c. Instrumentation Setup and Calibration

(1) Private industry and government participants set up and operated their candidate systems and turned over data to US Army Evaluation Center (AEC), APG, during the test. Representative views of candidate systems positioned at the test site can be found in Figures 1.1 through 1.8.

(2) The APSTM and WDL were set up, calibrated, and used to monitor and referee testing.

(3) Instrumentation locations were recorded.

d. Test Execution

(1) Participant-provided technologies were positioned on the grid in accordance with (IAW) customer requirements. The locations were recorded.

(2) Before the start of dissemination each day, referee instrumentation were powered on and operated to establish background concentrations.

(3) Before each trial, the TO announced when the simulant or interferent dissemination would begin. Simulant or interferent was disseminated with a disseminator IAW Paragraph 2.c. **NOTE**: The dissemination duration was dependent on the challenge material and all dissemination durations were recorded in the TO log.

(4) All trial information was recorded in the TO log, and a summary is provided in Table 1.1.

(5) Selection of the challenge material for each trial was based on customer needs and conditions on the grid. The challenge material used for each trial was recorded (Table 1.1).

(6) Quantities of disseminated challenge materials were determined by field personnel and recorded.

5. TEST DATA

a. A summary of the TO log is in Enclosure 1, Table 1.1.

b. A total of 42 trials were completed with biological and chemical simulants.

6. SUMMARY OF RESULTS

- a. Trial release data are in Enclosure 1, Table 1.1.
- b. Meteorological data are in Enclosure 1, Table 1.2
- c. Test instrument data are in Enclosure 1, Table 1.3

7. OBSERVATIONS/REMARKS/VISITORS

None.

SUBMITTED BY:

Signed by BARTHLOMEW, RUSSELL, GEORGE, 1266220932
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Russell Bartholomew
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RYAN W. HARRIS	Date
_____ Director, West Desert Test Center	

- 4 Encls
- 1. Data
- 2. References
- 3. Abbreviations
- 4. Distribution List

DISTRIBUTION approved for public release; distribution is unlimited. (August 2015). Other requests for this document shall be referred to US Army Dugway Proving Ground (DPG), Utah, Life Sciences Division, 2029 Burns Road, (TEDT-DPW-LS/R. Bartholomew), Dugway Proving Ground, Utah 84022.

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ENCLOSURE 1. DATA

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Table 1.1. Release Data; JUPITR ATD EW Leg TD.

Date (February 2015)	Trial Number	Simulant ^a	Interferent	Target Feed Rate	Quantity of Releases	Release Duration (mm:ss)	Actual Quantity Released (g)
3	PILOT4	SF ₆	NA ^b	21000 g/each ^c	1	00:01	21000
3	PILOT5	BG	NA	100 g/min	1	10:00	876.2
3	PILOT6	BG	NA	100 g/each	6	00:01	600
4	TDV1-1	MeS	False Alarm Trial ^d				
4	TDV5-1	SF ₆	NA	2000 g/each	1	00:01	20000
4	TDV2-1	BG	NA	100 g/min	1	10:00	1182.3
4	TDV4-1	BG	NA	100 g/each	9	03:00	900
4	TDV4-2	BG	NA	100 g/each	9	02:00	900
4	TDV3-1	BG	NA	50 g/min	1	10:00	704.5
4	TDV5-2	SF ₆	NA	20540 g/each	1	02:00	20540
5	TDV1-2	MeS	False Alarm Trial ^e				
5	TDV5-3	SF ₆	NA	18000 g/each	1	02:00	18000
5	TDV5-4	SF ₆	NA	20000 g/each	1	02:40	20000
5	TDV3-2	BG	NA	50 g/min	1	10:00	604.6
5	TDV4-3	BG	NA	100 g/each	10	02:15	1000
5	TDV2-2	BG	NA	100 g/min	1	10:00	953.6
5	TDV5-5	SF ₆	NA	NA	1	03:30	20000
6	TDV5-6	SF ₆	NA	20000 g/each	1	01:00	20000
6	TDV2-3	BG	NA	150 g/min	1	10:00	952
6	TDV3-3	BG	NA	100 g/min	1	10:00	431.5
6	TDV1-3	MeS	False Alarm Trial ^f				
6	TDV4-4	BG	NA	200 g/each	10	02:02	20000
6	TDV2-4	BG	NA	150 g/min	1	10:00	1013.2

Table 1.1. Release Data; JUPITR ATD EW Leg TD (Cont'd).

Date (February 2015)	Trial Number	Simulant	Interferent	Target Feed Rate	Quantity of Releases	Release Duration (mm:ss)	Actual Quantity Released (g)
8	TDV1-4	MeS	False Alarm Trial ^g				
8	TDV5-7	SF ₆	NA	20000 g/each	1	00:01	20000
8	TDV2-5	BG	NA	150 g/min	1	10:00	1631.3
8	TDV3-4	BG	NA	100 g/min	1	10:00	362
8	TDV4-5	BG	NA	100 g/each	10	00:10	1000
8	TDV4-6	BG	NA	100 g/each	6	00:10	600
8	TDV6-1	NA	Diesel	NA	4	04:30	NA
8	TDV6-2	NA	Diesel	NA	8	08:55	NA
8	TDV6-3	NA	Rubber	NA	2	24:00	NA
9	TDV3-5	BG	NA	20 g/min	7	07:40	167
9	TDV5-8	SF ₆	Kaolin	200 g/each	5	00:10	1000
9	TDV6-4	NA	Diesel	NA	1	18:00	NA
11	TDV4-7	BG	NA	100 g/each	5	00:10	500
11	TDV1-5	SF ₆	NA	5000 g/min	1	05:00	25000
11	TDV3-6	Btk	False Alarm Trial ^h				
11	TDV3-7	Btk	NA	20 g/min	1	10:00	176.5
12	TDV5-9	SF ₆	NA	20000 g/each	1	00:01	20000
12	TDV4-8	BG	NA	100 g/each	15	00:01	1500
12	TDV3-8	BG	NA	20 g/min	1	11:30	1132.7

^aSF₆ – sulfur hexafluoride; BG – *Bacillus atrophaeus*; MeS – methyl salicylate; Btk – *Bacillus thuringiensis kurstaki*.

^bNot applicable.

^cEach release.

^dTrial aborted during testing because of false alarm from referee equipment.

NOTE: Trial numbers identify test parameters. For example, the trial name TDV1-1 indicates the following: TDV = technical demonstration vignette; 1-1 = Phase 1-Repetition 1.

Table 1.2. Meteorological Test Data; JUPITR ATD EW Leg TD.

Date (February 2015)	Trial Number	Average Wind Direction (degrees)	Average Wind Speed (m/sec)	Mean Temperature (°C)	Mean Relative Humidity (percent)
3	PILOT4	167.17	1.91	9.87	66.46
3	PILOT5	178	1.96	9.87	66.15
3	PILOT6	False Alarm Trial ^a			
4	TDV1-1 ^b	129.63	1.41	6.71	71.01
4	TDV5-1	134	1.3	6.2	65.8
4	TDV2-1	181	1.2	3.7	69
4	TDV4-1	158.39	1.76	7.67	52.39
4	TDV4-2	176.31	1.78	6.08	59.49
4	TDV3-1	149.89	1.74	6.24	55.19
4	TDV5-2	226	1	3.8	61.7
5	TDV1-2	133.5	0.35	6.54	65.87
5	TDV5-3	155.68	2.58	10.71	38.22
5	TDV5-4	156.71	3.32	11.1	33.88
5	TDV3-2	154.6	2.57	10.65	36.37
5	TDV4-3	146.51	4.79	11.36	33.45
5	TDV2-2	142.33	4.57	10.53	34.12
5	TDV5-5	123.18	4.76	10.58	36.2
6	TDV5-6	153.76	5.3	14	25.8
6	TDV2-3	151.13	5.29	13.87	24.08
6	TDV3-3	181.9	1.3	12.1	28.9
6	TDV1-3	147.84	2.15	13.17	26.65
6	TDV4-4	148.42	2.49	11.95	30.3
6	TDV2-4	132.44	4.84	11.03	33.48
8	TDV1-4	164.81	2.85	13.2	50.05

Table 1.2. Meteorological Test Data; JUPITR ATD EW Leg TD (Cont'd).

Date (2015)	Trial Number	Average Wind Direction (degrees)	Average Wind Speed (m/sec)	Mean Temperature (°C)	Mean Relative Humidity (percent)
8	TDV5-7	144.33	3.17	13.39	50.4
8	TDV2-5	144.52	3.64	12.43	53.74
8	TDV3-4	144.07	3.95	11.56	56.98
8	TDV4-5	127.75	4.75	10.87	58.2
8	TDV4-6	125.44	4.68	10.34	58.34
8	TDV6-1	138.04	5.38	9.82	62.44
8	TDV6-2	130.7	3.88	9.11	63.6
8	TDV6-3	125.29	4.74	9.26	63.56
9	TDV3-5	294.04	1.79	6.47	60.23
9	TDV5-8	338.29	4.73	8.8	53.64
9	TDV6-4	352.74	3.71	8.7	50.84
11	TDV4-7	331.12	0.83	7.24	58.21
11	TDV1-5	178	0.94	1.06	70.41
11	TDV3-6	False Alarm Trial ^a			
11	TDV3-7	126.42	1.32	-1.65	70.65
12	TDV5-9	193	1.17	2.8	57
12	TDV4-8	105	1.15	-1.2	73.5
12	TDV3-8	168	0.88	-2.7	76.5

^aTrial aborted during testing because of false alarm from referee equipment.

^bTechnical Demonstration Vignette (Phase) 1- (Repetition) 1.

NOTE: Trial numbers identify test parameters. For example, the trial name TDV1-1 indicates the following: TDV = technical demonstration vignette; 1-1 = Phase 1-Repetition 1.

Table 1.3. Test Instruments Data; JUPITR ATD EW Leg TD.

Trial Number	Dissemination Equipment	Dissemination Type	Dissemination Start Time MDT ^a (hhmm:ss)	Dissemination End Time MDT (hhmm:ss)
PILOT4	Composition C-4 (C-4)	NA ^b	2120:00	2132:00
PILOT5	EDDS ^c	Line	2147:00	2157:00
PILOT6	False Alarm Trial ^d			
TDV1-1	NA	NA	2020:00	2043:00
TDV5-1	C-4	Point	2137:00	2138:40
TDV2-1	Skil [®] blower	Line	2237:00	2248:30
TDV4-1	Air cannon	Line	0011:00	0014:00
TDV4-2	Air cannon	Line	0110:00	0112:00
TDV3-1	Skil [®] blower	Line	0219:00	0229:30
TDV5-2	C-4	Point	0306:00	0308:00
TDV1-2	False Alarm Trial ^e			
TDV5-3	C-4	Line	2301:00	2303:00
TDV5-4	C-4	Line	2330:00	2332:40
TDV3-2	Skil [®] blower	Line	2355:00	0005:00
TDV4-3	Air cannon	Line	0044:00	0046:15
TDV2-2	Skil [®] blower	Line	0121:00	0131:00
TDV5-5	C-4	Point	0209:00	0212:30
TDV5-6	C-4	Point	2034:00	2035:00
TDV2-3	EDDS/Skil [®] blower	Line	2135:00	2145:00
TDV3-3	EDDS/Skil [®] blower	Line	2234:00	2244:00
TDV1-3	False Alarm Trial ^f			
TDV4-4	Air cannon	Line	0006:00	0008:20
TDV2-4	EDDS	Line	127:00	137:00
TDV1-4	False Alarm Trial ^g			

Table 1.3. Test Instruments Data; JUPITR ATD EW Leg TD (Cont'd).

Trial Number	Dissemination Equipment	Dissemination Type	Dissemination Start Time MDT (hhmm:ss)	Dissemination End Time MDT (hhmm:ss)
TDV5-7	C-4	Point	2056:00	2057:20
TDV2-5	EDDS/Skil [®] blower	Line	2151:00	2200:15
TDV3-4	Skil [®] blower	Line	2246:00	2254:30
TDV4-5	Air cannon	Point	0014:00	0014:10
TDV4-6	Air cannon	Point	0044:00	0044:10
TDV6-1	Burn pan	Point	0109:00	0113:30
TDV6-2	Burn pan	Point	0130:00	0138:55
TDV6-3	Burn pan	Point	0151:00	0215:00
TDV3-5	Skil [®] blower	Line	2106:00	2113:40
TDV5-8	Air cannon	Point	2239:00	2239:10
TDV6-4	Burn pan	Point	2357:00	0015:00
TDV4-7	Air cannon	Point	0052:00	0052:10
TDV1-5	NA	Line	2101:00	2106:00
TDV3-6	False Alarm Trial ^h			
TDV3-7	Skil [®] blower	Line	2238:00	2248:00
TDV5-9	C-4	Point	2034:00	2035:50
TDV4-8	Air cannon	Point	2327:00	2328:15
TDV3-8	Skil [®] blower	Line	0012:00	0023:30

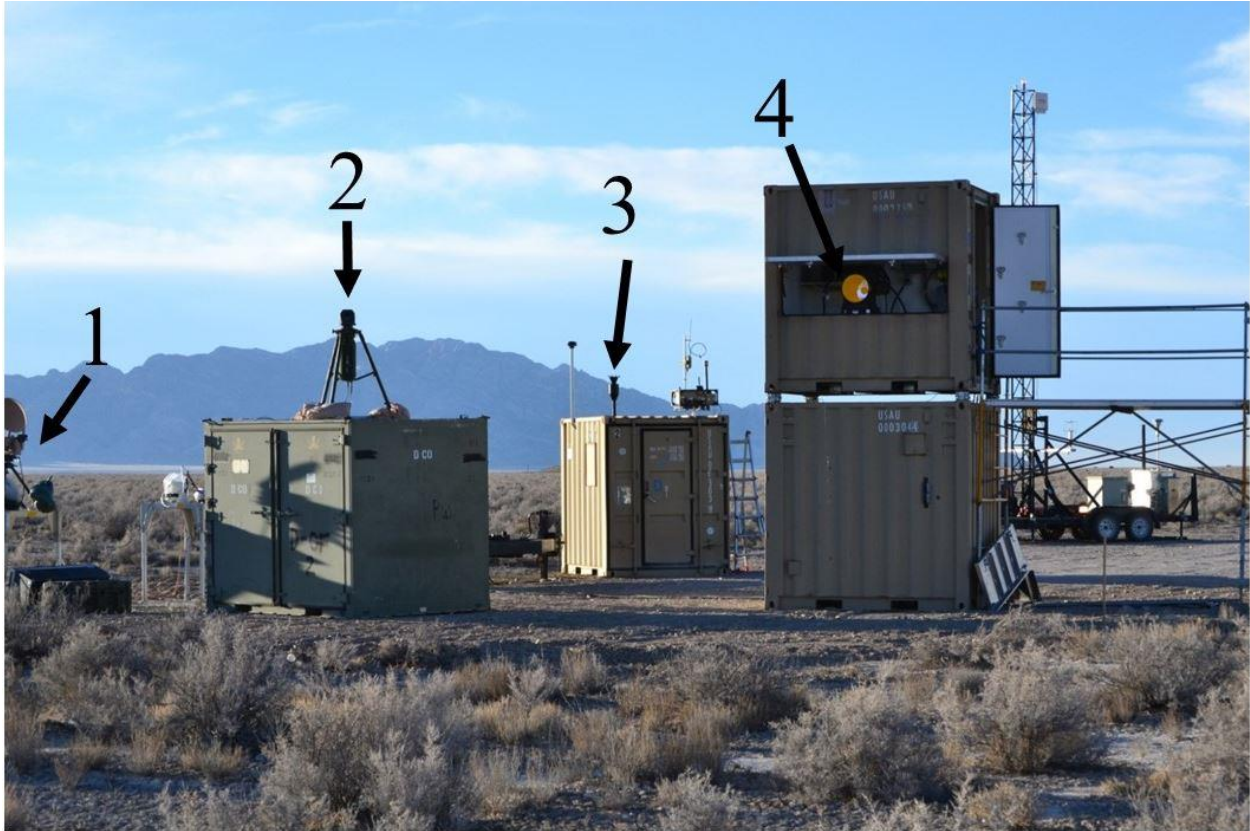
^aMountain Daylight Time.

^bNot applicable.

^cEductor Dry Dissemination System.

^dTrial aborted during testing because of false alarm from referee equipment.

NOTE: Trial numbers identify test parameters. For example, the trial name TDV1-1 indicates the following: TDV = technical demonstration vignette; 1-1 = Phase 1-Repetition 1.



NOTE: Systems shown in the figure are identified as follows:

1. Manportable¹ Surveillance and Target Acquisition Radar (MSTAR).
2. Joint Service Lightweight Standoff Chemical Agent Detector (JSLSCAD).
3. Joint Biological Standoff Detection System (JBSDS) Increment 1.
4. Joint Biological Point Detection System (JBPDS).

Figure 1.1. Candidate Detectors Positioned at Test Site, View 1; JUPITR ATD EW Leg TD.

¹The word “he” or “man” when used in this document represents both the masculine and feminine genders, unless otherwise specifically stated.



- NOTE:** Systems shown in the figure are identified as follows:
1. Joint Service Lightweight Standoff Chemical Agent Detector (JSLSCAD).
 2. Manportable Surveillance and Target Acquisition Radar (MSTAR).

Figure 1.2. Candidate Detectors Positioned at Test Site, View 2; JUPITR ATD EW Leg TD.



NOTE: Systems shown in the figure are identified as follows:

1. Manportable Surveillance and Target Acquisition Radar (MSTAR).
2. Joint Service Lightweight Standoff Chemical Agent Detector (JSLSCAD).
3. Joint Biological Point Detection System (JBPDS).
4. Joint Biological Standoff Detection System (JBSDS).

Figure 1.3. Candidate Detectors Positioned at Test Site, View 3; JUPITR ATD EW Leg TD.



- NOTE:** Systems shown in the figure are identified as follows:
1. Manportable Surveillance and Target Acquisition Radar (MSTAR).
 2. Joint Service Lightweight Standoff Chemical Agent Detector (JSLSCAD).

Figure 1.4. Candidate Detectors Positioned at Test Site, View 4; JUPITR ATD EW Leg TD.



NOTE: Systems shown in the figure are identified as follows:
1. Joint Biological Point Detection System (JBPDS).
2. Atomic Emissions Detector (AED).

Figure 1.5. Candidate Detectors Positioned at Test Site, View 5; JUPITR ATD EW Leg TD.



NOTE: Systems shown in the figure are identified as follows:
1. Joint Biological Point Detection System (JBPDS).
2. Tactical Biological Detector (TacBio) II.

Figure 1.6. Candidate Detectors Positioned at Test Site, View 6; JUPITR ATD EW Leg TD.



NOTE: The system shown in the figure is the Instantaneous Biological Analyzer and Collector (IBAC).

Figure 1.7. Candidate Detector Positioned at Test Site, View 7; JUPITR ATD EW Leg TD.



- NOTE:** Systems shown in the figure are identified as follows:
1. Atomic Emissions Detector (AED).
 2. Joint Service Lightweight Standoff Chemical Agent Detector (JSLSCAD).
 3. Closed Circuit Television (CCTV).
 4. Joint Chemical Agent Detector (JCAD).

Figure 1.8. Candidate Detectors Positioned at Test Site, View 8; JUPITR ATD EW Leg TD.

ENCLOSURE 2. REFERENCES

1. US Army Dugway Proving Ground (DPG), Utah, *Operations Plan (OPLAN) for the Sophos/Kydoimos (S/K) Challenge-I*, US Army Test and Evaluation Command (ATEC) Project Number 2014-DT-DPG-ARSPT-F9492, West Desert Test Center (WDTC) Document Number WDTC-OP-14-068, 13 August 2014.

ENCLOSURE 3. ABBREVIATIONS

ADSS – ATEC Decision Support System

AEC – US Army Evaluation Center

AED – atomic emissions detector

APG – Aberdeen Proving Ground

APST[™] – Aerodynamic Particle Sizer[®]

ATD – advanced technology demonstration

ATEC – US Army Test and Evaluation Command

BG – *Bacillus atrophaeus*

Btk – *Bacillus thuringiensis kurstaki*

C-4 – composition C-4

CB – chemical/biological

CCTV – closed-circuit television

CP – command post

DPG – US Army Dugway Proving Ground

EDDS – Eductor Dry Dissemination System

EW – early warning

FP – force protection

FTIR – Fourier-transform infrared

IAW – in accordance with

IBAC – Instantaneous Biological Analyzer and Collector

JBPDS – Joint Biological Point Detection System

JBSDS – Joint Biological Standoff Detection System

JCAD – Joint Chemical Agent Detector

JSLSCAD – Joint Service Lightweight Standoff Chemical Detector

JUPITR – Joint United States Forces Korea Portal and Integrated Threat Recognition

LIDAR – light detection and ranging

MDT – Mountain Daylight Time

MeS – methyl salicylate

MSTAR – Manportable Surveillance and Target Acquisition Radar

NA – not applicable

OPLAN – operational plan

ppL – particles per liter

PSD – particle-size distribution

PWIDS – Portable Weather Instrumentation Data System.

RH – relative humidity

SF₆ – sulfur hexafluoride

TacBio – Tactical Biological Detector

TD – technical demonstration

TO – test officer

USFK – US Forces Korea

WDL – West Desert LIDAR

WDTC – West Desert Test Center

ENCLOSURE 4. DISTRIBUTION LIST

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